

**Course title:** Innovative and cleaner inorganic technologies – ~~selectable~~ / regular course

**Number of contact hours:** 45 hours (15 lecture, 30 laboratories)

**ETCS credits:**

**Course description:** The lecture reviews the inorganic fertilizers production technologies and rules for its application, as well as characteristic of soil environment, functions and division of selected nutrients, fertilizers classification. Production technologies of phosphoric acid, nitrogen and phosphoric fertilizers, one- and two-component fertilizers will be provided. Characteristic of multi-component fertilizers, mixed and complex fertilizers, characteristic and problems of the fertilizers market will be discussed. New solutions in raw materials will be reviewed. Sodium phosphates production technologies and its application, technological modifications according to sustainable development will be discussed. Analysis and assessment of technological processes, advantages and disadvantages of basic inorganic technologies and directions of its development will be provided. Industrial waste streams and waste management techniques as well as waste management rules and effective ways for reduction and preventing waste production will be reviewed.

The lecture will also review the dependence between civilization development and environment threats. The idea of sustainable development of cleaner technologies and green chemistry will be given. The issue of renewable raw materials will be discussed. Proecological methods of obtaining nanomaterials as well as selected methods of recycling and waste management will be provided. Technologies for gas purification from malodorous compounds will be given.

**Education effects** (P7S\_UW, P7S\_WG):

- **knowledge:** student knows the most important types of fertilizers, technologies of their production, their application; recognizes basic inorganic technologies; knows techniques of waste management; knows environment treats; recognizes cleaner technologies; knows examples of environment friendly methods for production of nanomaterials; knows methods for gas purification

- **skills:** student can point the green and proecological method for production of basic inorganic materials; is able to predict the characteristic features of such technologies

- **social:** student understands the reason of using green and cleaner technologies; is able to work independently and in the group both at the laboratories and during preparation of the report

**Literature:**

1. Anne E. Marteel-Parrish, Martin A. Abraham, Green Chemistry and Engineering: A Pathway to Sustainability, 2013, Wiley
2. Paul Anastas, Julie B. Zimmerman, Innovations in Green Chemistry and Green Engineering, 2013, Springer

**Assessment method:** Final test, completing the laboratories (presence and delivering of reports from each performed exercise)

**Prerequisites:** Basic knowledge in chemical technology and engineering

**Primary target group:** All specialties students

**Lecturer:** dr hab. inż. Marcin Banach, prof. PK; dr inż. Katarzyna Gorazda, dr inż. J. Pulit-Prociak,  
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